REMARKS

Upon entry of the Amendment, claims 1-4 and 15-50 are all the claims pending in the application. Claims 15-50 are withdrawn from consideration. Claims 2-4 are allowed. Claim 1 is amended.

Claim 1 is rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by U.S. Published Application No. 2003/0179601 to Seyyedy *et al.* ("Seyyedy '601").

Claim 1 presently recites that the diffusion barrier layer is made of ZrN.

In contrast, Figure 1B of Seyyedy '601 discloses a sense layer 172, a tunneling layer 170, a pinned layer 168, a cap 160, and a lower conductive trace 156. Seyyedy '601 discloses that liner 158 and cap 160 serve as a diffusion barrier layer that comprises Ta, TaN, TiN, or WN. See, paragraph [0033].

In this regard, Seyyedy '601 fails to describe or suggest a diffusion barrier layer made of ZrN. Ta, TaN, TiN, or WN, as disclosed in Seyyedy '601, are each different from ZrN.

Further, ZrN is unexpectedly superior in thermal stability, as compared to TiN. Zirconium has lower oxide and nitride formation free energies than that of titanium. The oxide formation free energy of zirconium and titanium is shown below:

Appendix I

	Oxide Formation Free Energy @298K (kJ/mol)
Al_2O_3	−526.7
MgO	−572.8
Ta_2O_5	−397.1
ZrO_2	−518.5
HfO_2	−542.2
WO_3	−254.7
SiO_2	−402.8
TiO_2	−441.1
CaO	−604.6
Li_2O	−561.0
CeO_2	−485.7
RuO_2	−126.9
MnO_2	−233.2
CoO	−213.5
NiO	−216.5
FeO	−244.5
Fe_2O_3	−247.2
Fe_3O_4	−253.7
CuO	−127.3

See "A handbook of oxide material," Samsonovs, Moscow, 1969. The nitride formation free energy of zirconium is similarly lower than that of titanium. As described at page 50 of the specification, a lower nitride formation free energy avoids destabilizing the nitride layers through the diffusion of nitrogen into the layers connected on the bottom and top surfaces of the nitride layers, and thus degrading the diffusion-resistance of the nitride layers.

The diffusion barrier made of ZrN also has a lower resistance than a diffusion barrier comprising TiN. The table below shows the specific resistance of certain films prepared by Applicants:

	Measured SpecificResistance ($\mu\Omega \cdot cm$)
Al2O3	>MΩ
MgO	>MΩ
TaN	238
ZrN	145
SiO2	>MΩ
TiN	254
Al	4.4
Co90Fe10	11
Cu	3.2
N81Fe19	30

As shown above, the specific resistance of the ZrN film is lower than the specific resistance of the TiN film. Specifically, the specific resistance of the ZrN film is about 57 % of the specific resistance of the TiN film (i.e., 145/254 = 0.57). This effectively reduces the through thickness resistance of a magnetoresistance element and improves the MR ratio.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

Ken Sakurabayashi
Registration No. 58,490

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

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